CAREER GUIDE FOR MECHANICAL ENGINEERS

SOC Code: 17-2141

Pay Band: 5 (Salary Structure)

Standard Occupational Description: Perform engineering duties in planning and designing tools, engines, machines, and other mechanically functioning equipment. Oversee installation, operation, maintenance, and repair of such equipment as centralized heat, gas, water, and steam systems.

Mechanical Engineer positions in the Commonwealth are assigned to the following Roles in the Architecture and Engineering Career Group:

Architect/ Engineer I
Architecture/ Engineering Manager I

While Mechanical Engineers within the Commonwealth are all located within the Architecture and Engineering Career Group, individuals may want to pursue other managerial opportunities within the Commonwealth depending upon individual training, education, knowledge, skills, abilities, and interests.

Other Career Group(s) that may be of interest are:
General Administration

Program Administration

SKILLS, KNOWLEDGE, ABILITIES AND TASKS

(Technical and Functional Expertise)

Skills

Note: *The technical and functional skills listed below are based on general occupational qualifications for Mechanical Engineers commonly recognized by most employers. Typically, you will not be required to have all of the skills listed to be a successful performer. Recruitment and selection standards for an individual state job must be based on the specific knowledge, skills, and abilities for that job as indicated in the job announcement and job description in the Employee Work Profile.*

1. Using mathematics to solve problems.
2. Generating or adapting equipment and technology to serve user needs.
3. Using scientific rules and methods to solve problems.
4. Analyzing needs and product requirements to create a design.
5. Understanding written sentences and paragraphs in work related documents.
6. Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
7. Understanding the implications of new information for both current and future problem-solving and decision-making.
8. Determining the kind of tools and equipment needed to do a job.
9. Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
10. Considering the relative costs and benefits of potential actions to choose the most appropriate one.
11. Conducting tests and inspections of products, services, or processes to evaluate quality or performance.

12. Communicating effectively in writing as appropriate for the needs of the audience.
13. Talking to others to convey information effectively.
14. Determining causes of operating errors and deciding what to do about it.

Knowledge

Note: *The technical and functional knowledge statements listed below are based on general occupational qualifications for Mechanical Engineers commonly recognized by most employers. Typically, you will not be required to have all of the knowledge listed to be a successful performer. Recruitment and selection standards for an individual state job must be based on the specific knowledge, skills, and abilities for that job as indicated in the job announcement and job description in the Employee Work Profile.*

The **Knowledge** of:

1. The practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
2. Design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
3. Arithmetic, algebra, geometry, calculus, statistics, and their applications.
4. Circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
5. The prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub- atomic structures and processes.
6. Machines and tools, including their designs, uses, repair, and maintenance.
7. The structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

Abilities

Note: *The technical and functional abilities listed below are based on general occupational qualifications for Mechanical Engineers commonly recognized by most employers. Typically, you will not be required to have all of the abilities listed to be a successful performer. Recruitment and selection standards for an individual state job must be based on the specific knowledge, skills, and abilities for that job as indicated in the job announcement and job description in the Employee Work Profile.*

The **Ability** to:

1. Understand and organize a problem and then to select a mathematical method or formula to solve the problem.
2. Apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense.
3. Read and understand information and ideas presented in writing.
4. Add, subtract, multiply, or divide quickly and correctly
5. See details of objects at a close range (within a few feet of the observer).
6. Imagine how something will look after it is moved around or when its parts are moved or rearranged.
7. Combine separate pieces of information, or specific answers to problems, to form general rules or conclusions. It includes coming up with a logical explanation for why a series of seemingly unrelated events occur together.
8. Correctly follow a given rule or set of rules in order to arrange things or actions in a certain order. The things or actions can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.
9. Tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.

10. Listen to and understand information and ideas presented through spoken words and sentences.
11. Communicate information and ideas in speaking so others will understand.
12. Communicate information and ideas in writing so others will understand.
13. Come up with a number of ideas about a given topic. It concerns the number of ideas produced and not the quality, correctness, or creativity of the ideas.
14. Come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.
15. Produce many rules so that each rule tells how to group (or combine) a set of things in a different way.
16. Keep the hand and arm steady while making an arm movement or while holding the arm and hand in one position.
17. Quickly make sense of information that seems to be without meaning or organization. It involves quickly combining and organizing different pieces of information into a meaningful pattern.
18. Speak clearly so that it is understandable to a listener.
19. Match or detect differences between colors, including shades of color and brightness.
20. Remember information such as words, numbers, pictures, and procedures.

Tasks

1. Designs products and systems to meet process requirements, applying knowledge of engineering principles.
2. Oversees installation to ensure machines and equipment are installed and functioning according to specifications.
3. Coordinates building, fabrication, and installation of product design and operation, maintenance, and repair activities to utilize machines and equipment.
4. Specifies system components or directs modification of products to ensure conformance with engineering design and performance specifications.
5. Inspects, evaluates, and arranges field installations and recommends design modifications to eliminate machine or system malfunctions.
6. Alters or modifies design to obtain specified functional and operational performance.
7. Investigates equipment failures and difficulties, diagnoses faulty operation, and makes recommendations to maintenance crew.
8. Studies industrial processes to determine where and how application of equipment can be made.
9. Researches and analyzes data, such as customer design proposal, specifications, and manuals to determine feasibility of design or application.
10. Plans and directs engineering personnel in fabrication of test control apparatus and equipment, and develops procedures for testing products.
11. Confers with establishment personnel and engineers to implement operating procedures and resolve system malfunctions, and to provide technical information.
12. Develops models of alternate processing methods to test feasibility or new applications of system components, and recommends implementation of procedures.
13. Tests ability of machines to perform tasks.
14. Selects or designs tools to meet specifications, using manuals, drafting tools, computer, and specialized software programs.
15. Assists drafter in developing structural design of product, using drafting tools or computer-assisted design/drafting equipment and software.
16. Conducts experiments to test and analyze existing designs and equipment to obtain data on performance of product, and prepares reports.

17. Determines parts supply, maintenance tasks, safety procedures, and service schedule required to maintain machines and equipment in prescribed condition.

INTERESTED?

Like people, occupations have traits or characteristics. These characteristics give important clues about the nature of the work and work environment, and give you an opportunity to match your own personal interests to a specific occupation. When you choose a job in an occupation that matches your own interests you have taken an important step in planning a successful and rewarding career.

Mechanical Engineering mainly considered a "Realistic Occupation" because it involves work activities that include practical, hands-on problems and solutions. They often deal with plants, animals, and real-world materials like wood, tools, and machinery. Many of the occupations require working outside, and do not involve a lot of paperwork or working closely with others. It is also be referred to as "Conventional" since it may frequently involve following set procedures and routines, include working with data and details more than with ideas, and usually there is a clear line of authority to follow. It also is called an "Investigative Occupation" since it frequently involves working with ideas, and requires an extensive amount of thinking. It can involve searching for facts and figuring out problems mentally.

LICENSURE, REGISTRATION, OR CERTIFICATION REQUIREMENTS

Generally this is not required for Mechanical Engineer positions in state government. However, to improve career advancement opportunities, you should consider the advantages of certification and include this step in your self-development plan. The Professional Engineer license is required for some Mechanical Engineer positions. These positions are identified by each state agency.

Licensing information can be found on the Department of Professional & Occupational Regulations' web site at http://www.dpor.state.va.us

EDUCATIONAL, TRAINING, AND LEARNING OPPORTUNITIES

Professional occupations like Mechanical Engineers usually require a college degree and may require some job-specific training.

Sources of educational, training, and learning opportunities include:

1. Graduate from an engineering curriculum accredited by the Accreditation Board for Engineering and Technology.
2. Join professional organizations.
3. Specific data regarding a number of engineering disciplines follows:

MECHANICAL ENGINEERING: An instructional program that prepares individuals to apply mathematical and scientific principles to the design, development and operational evaluation of physical systems used in manufacturing and end-product systems used for specific uses, including machine tools, jigs and other manufacturing equipment; stationary power units and appliances; engines; self-propelled vehicles; housings and containers; hydraulic and electric

systems for controlling movement; and the integration of computers and remote control with operating systems.

COMMONWEALTH COMPETENCIES

Competencies are a set of identified behaviors, knowledge, skills, and abilities that directly and positively impact the success of employees and the organization. Competencies can be observed and measured. When consistently demonstrated, competencies make employees particularly effective in their work. Competencies help lay out a road map to career success. You can use the Commonwealth Competencies to help improve your individual performance by adopting behaviors that make high performing employees successful in their jobs. In this way, you can use the Commonwealth Competencies for your further professional development.

The Commonwealth Competencies are:

1. Technical and Functional Expertise
2. Understanding the Business
3. Achieving Results
4. Serving the Customer
5. Teamwork
6. Interpersonal and Communication Skills
7. Leadership and Personal Effectiveness

The above competencies may be applied to employees throughout the Commonwealth of Virginia. They can be rank-ordered by agencies and hiring managers to represent the needs of a specific job. The rank ordering will change depending upon the occupation, an organization's priorities, the actual job requirements, and the supervisor's preferences.

Career success is both about what you do (applying your technical knowledge, skills, and ability) and how you do it (the consistent behaviors you demonstrate and choose to use) while interacting and communicating with others. Hopefully, by studying the Commonwealth competencies, identifying your developmental opportunities, and working to refine your own competence, you can take charge of your career!

For additional information about the **Commonwealth Competencies** go to: http://jobs.state.va.us/cc_planningctr.htm. For the competencies, we first list the competencies and then define each. Finally, we list competency indicators; to describe what successful performance looks like.

COMMONWEALTH CAREER PATH

Career opportunities in the Commonwealth are not limited to moving “up” to the next highest role and pay band, changing positions, or to becoming a supervisor. That’s because most roles describe a broad group of occupationally related positions that perform a range of work that requires increased knowledge and skills. For that reason, Commonwealth roles describe the career paths within the same or higher-level role for the same or different Career Group. The broad salary range and the Commonwealth’s pay practices provide flexibility in recognizing career development and advancement. (Salary Structure)

For example:

Pay Band	Practitioner Role
5	Architect/Engineer I
	⬇
6	Architect/Engineer II

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Pay Band	Manager Role
5	Architect/Engineer Manager I
	⬇
6	Architect/Engineer Manager II
	⬇
7	Architect/Engineer Manager III
	⬇
8	Architect/Engineer Manager IV

Sample Career Path

Architect/Engineer I

The Architect/Engineer I role provides career tracks for architects or engineers whose expertise levels range from trainee to advanced level. Responsibilities include applying architecture/engineering principles and practices to projects of varying complexity in specialty areas. Specialty areas include those requiring knowledge of civil, environmental, structural, mechanical, electrical, transportation, traffic, safety, materials, or rehabilitation engineering and architecture.

Architect/Engineer II

The Architect/Engineer II role provides career tracks for architects or engineers who serve as an expert or first line supervisor. Duties include evaluating the plans and specifications for capital outlay projects prepared by other architects and engineers; or for applying related engineering principles and practices to complex, extensive and diversified engineering projects in specialty areas.

Architecture/Engineering Manager I

The Architecture/Engineering Manager I role provides career tracks for managers who manage various administrative, budgetary, planning, scheduling and technical activities related to multiple complex architectural/engineering projects or programs and the staff performing related functions. These functions draw upon knowledge of specialty engineering; capital outlay or other construction projects, transportation, water and wastewater projects or programs and health and safety related operations.

Architecture/Engineering Manager II

The Architecture/Engineering Manager II role provides career tracks for managers who manage, coordinate, and direct the activities of one or more specialized transportation or environmental engineering or health and safety related program operations in their assigned geographic or divisional area. This role also provides career tracks for managers who manage staff and resources related to the procurement, design, construction or renovation of capital projects or non-capital outlay for an entire agency's construction and maintenance reserve programs. This includes budgetary, planning, scheduling, public relations, human resource functions, and technical activities related to a broad range of engineering, administrative and other projects or programs.

Architecture/Engineering Manager III
The Architecture/Engineering Manager III role provides career tracks for managers who direct the transportation engineering, construction, maintenance, administrative and other operations and programs of a defined geographic transportation district. This role provides career tracks for managers who serve as an assistant to the Commissioner for Transportation and direct the operations of divisions and/or districts in areas such as administration, planning and operations. In addition, this role provides career tracks for executive level of Engineering and Buildings, and Facilities Management managers for the Commonwealth and for managers of an agency's design and construction projects that involve multiple facilities with special requirements, such as security provisions and long-term development and evaluation of programs.

ADDITIONAL OCCUPATIONAL INFORMATION CAN BE FOUND AT:

O*NET (Occupational Information Network)

http://online.onetcenter.org/gen_search_page

Virginia Employment Commission
http://www.alex.vec.state.va.us/

Department of Professional & Occupation Regulation
http://www.state.va.us/dpor/conNEW_reg.pdf

Career One Stop
http://www.careeronestop.org/

Virginia Career Resource Network
http://www.vacrn.net/